Q1 Solution:-

$n = 10$

$$\bar{X} = \frac{10+10+9.8+10.2+10.1+10.2+10.1+9.9+10+1}{10}$$

$\bar{X} = 10.03$ Volt

$d_i = X_i - \bar{X}$

$d_1 = 10 - 10.03 = -0.03$ Volt

No. of Reading	10	10	9.8	10.2	10.1	10.2	10.1	10.0	9.9	10
Deviation from the mean	-0.03	-0.03	-0.23	0.17	0.07	0.17	0.07	-0.03	-0.13	-0.03

$$\delta = \sqrt{\frac{\Sigma d^2}{n-1}} = 0.125 \text{ Volt}$$

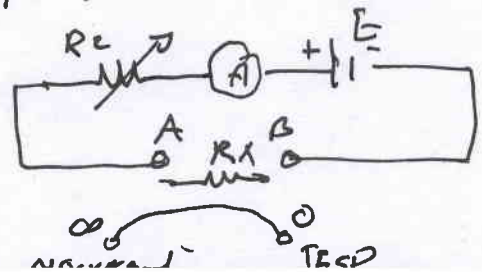
Variance $= \delta^2 = 0.0156$

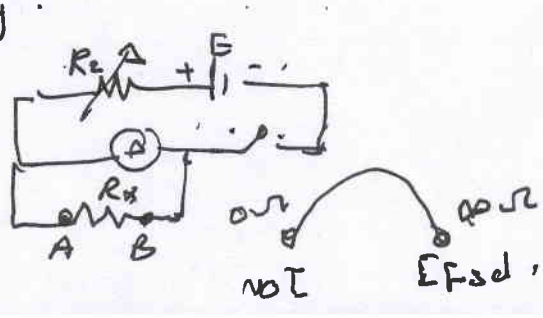
$r = \pm 0.6745\,\sigma^2 = \pm 0.674\,(0.125)$

$= \pm 0.0843$ Volt

Q2

series	Shunt
1. is used for any R.	1. to measure very Low R.
2. Rx is shunted across the meter.	2. Rx is series with the meter.
3. non-linear scale with zero at right and ∞ at left	3. non-linear zero at left ∞ at right
4. Not used switch	4. use switch to disconnect the battery.





Q3 $[(R_1)/(F R_2 R_3)$

$= \frac{1}{F R_3}$

$= \frac{\text{Time} * \text{Current}}{\text{Time} * \text{Voltage}}$

$= \frac{\text{Time}^2 * \text{current}^2}{\text{Mass} * \frac{\text{distance}^2}{\text{Time}^2}}$

$= \frac{\text{Time}^4 * \text{current}^2}{\text{Mass} * \text{distance}^2}$

$= [M^{-1} L^{-2} I^2 T^4]$ basic dimension

$= [Kg^{-1} M^{-2} A^2 Sec^4]$ basic unit

Capacitance $= [M^{-1} L^{-2} I^2 T^4] = \frac{1}{F R_3}$

$F = \frac{1}{T}$

Voltage = Work done / charge

charge = current * t

= Work done =

= Force * distance

= mass * acc. * dis

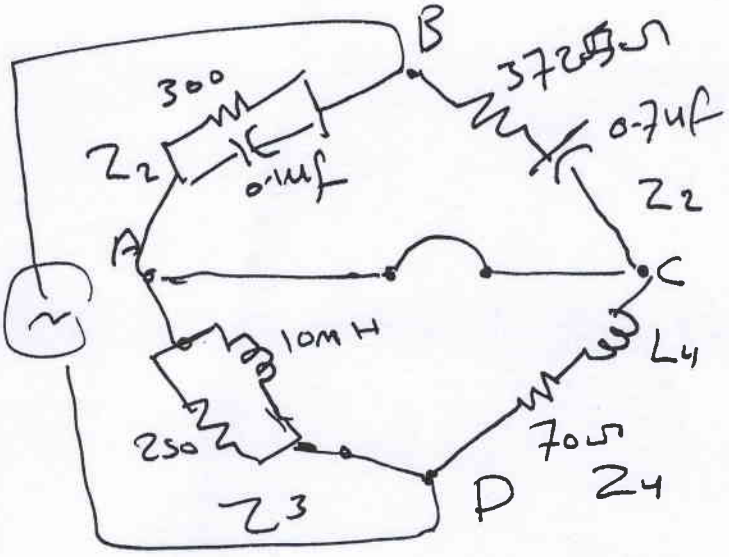
= mass * velocity / Time * di

= mass * dis. / Time^2 * dis

Q4.)
1. F
2. F
3. T
4. F
5. T
6. T

Q5

Solution:-



$R_1 = 300\Omega$

$B_{C1} = \frac{1}{X_{C1}} = 2\times10^{-3}\,\mho$

$X_{C1} = \frac{1}{2\times10^{-3}} = 500\Omega$

$C_1 = \frac{1}{2\pi f X_C} = 0.1\,uf$

$R_2 = 372.5\Omega$

$X_{C_2} = 75.5\,\Omega$

$C_2 = 0.7uf$

$R_3 = 250\Omega$ $L_3 = 10\,mH$, $R_4 = 70\Omega$, $Z_4 = ?$

$\frac{1}{X_{C1}} = 2\times10^{-3}\,\mho$ $X_{C_2} = 75.5\Omega$

$Y_1 = \frac{1}{R_1} + j\frac{1}{X_{C1}} = \frac{1}{R_1} + jwC_1 = \frac{1}{360} + j2\times10^{-3}$

$Y_1 = 3.33*10^{-3} + j2\times10^{-3} \Rightarrow Y_1 = 3.887*10^{-3}\angle 30.96^\circ$

$Z_1 = \frac{1}{Y_1} = 257.24\angle -30.96 = 220.58 - j132.553$

$Z_2 = R_2 - jX_{C_2} = 372.5 - j75.5 = 379.65\angle -11.45$

$= 380\angle -11.45$

$Y_3 = \frac{1}{R_3} - \frac{j}{wL_3} = 4\times10^{-3} - j5.305\times10^{-3} = 6.644\times10^{-3}\angle -52.1$

$Z_4 = 150.5\angle 52.98$

at balance: ① $Z_1Z_4 = Z_2Z_3$ ② $\theta_1 + \theta_4 = \theta_2 + \theta_3$

طريقة الزاوية

② $-30.96 + \theta_4 = -11.45 + 52.98$

$\theta_4 = 72.49^\circ$

$\tan\theta_4 = \frac{wL_4}{R_4} \Rightarrow \tan 72.49 = \frac{wL_4}{70}$

$wL_4 = 3.169*70 = 221.87\Omega$

$L_4 = 11.77\,mH$

Q5

الطريقة الثانية

$$Z_1 Z_4 = Z_2 Z_3$$
$$257.24 \angle Z_4 = 380 \angle 150.5$$
$$Z_4 = 222.32$$
$$Z_4 = 222.32 \angle 72.49$$
$$= 66.88 + j\,212.01$$
$$\therefore \omega L = 11.24\ mH$$

طريقة الأساسية $Y_1 = \frac{1}{R_1} + jwC_1$, $Z_2 = R_2 - \frac{1}{wC_2}$, $Y_3 = \frac{1}{R_3} - \frac{j}{wL_3}$

$Z_4 = R_4 + jwL_4$

at balance $Z_1 Z_4 = Z_2 Z_3 \Rightarrow \frac{Z_4}{Y_1} = \frac{Z_2}{Z_3} \Rightarrow Z_4 Y_3 = Z_2 Y_1$

$$(R_4 + jwL_4)\left(\frac{1}{R_3} - \frac{j}{wL_3}\right) = \left(R_2 - \frac{j}{wC_2}\right)\left(\frac{1}{R_1} - jwC_1\right)$$

$$\frac{R_4}{R_3} - j\frac{R_4}{wL_3} + j\frac{wL_4}{R_3} + \frac{L_4}{L_3} = \frac{R_2}{R_1} + jwR_2C_1 - \frac{j}{wR_1C_2} + \frac{C_1}{C_2}$$

$$\frac{R_4}{R_3} + \frac{L_4}{L_3} = \frac{R_2}{R_1} + \frac{C_1}{C_2} \quad \cdots (1)$$

$$L_4 = L_3\left[\frac{R_2}{R_1} + \frac{C_1}{C_2} - \frac{R_4}{R_3}\right]$$
$$= 10 \times 10^{-3}\left[\frac{372.5}{300} + \frac{0.1\mu f}{0.7\mu f} - \frac{72}{250}\right]$$

$$\therefore L_4 = 11\ mH$$

الطريقة الرابعة $Z_4 = Z_2 Z_3 Y_1$

$$Y_1 = \frac{1}{300} + \frac{j}{500}$$
$$Y_1 = 3.33 \times 10^{-3} + j\,2 \times 10^{-3}$$
$$Z_1 = \frac{1}{Y_1} = 257.24 \angle -31.5$$
$$Y_3 = \frac{1}{250} - \frac{j}{188.4}$$
$$= 4 \times 10^{-3} - j\,5.31 \times 10^{-3}$$
$$Z_3 = \frac{1}{Y_3} = 150.4 \angle -53.2^\circ$$
$$= 90.86 - j\,119.79$$

$$Z_4 = 380.1 \angle 11.46 * 150.4 \angle -53 * 3.884 \times 10^{-3} \angle 31$$
$$= 86.894 + j\,212.643$$

Q6

① Accelerating Voltage

$l = 6\,cm$, $d = 0.5\,cm$, $L = 40\,cm$, $AV = 80$

$D = 7\,cm$ & $t = 20 * 10^{-9}$ sec.

The ~~Deflection~~ distance From the beginning of deflection plates to the Screen will be:-

$$X = \frac{l}{2} + L = \frac{6}{2} + 40 = 43\,cm = 0.43\,cm$$

$$Vox = \frac{X}{t} = \frac{0.43}{(20*10^{-9})} = 2.15 * 10^{7}\ m/sec$$

$$\frac{1}{2} m Vox^2 = e Ea \Rightarrow Ea = \frac{m Vox^2}{2e} = \frac{9.1*10^{-31} * (2.15*10^{7})^2}{2 * 1.6 * 10^{-19}}$$

$$\Rightarrow \boxed{Ea = 1.31452\ KV}$$

② Vertical Feild intensity

$$Ey = \frac{-Ed}{d}$$

$$D = \frac{l L Ed}{2 d Ea} \Rightarrow Ed = \frac{2 d Ea D}{l L} = 38.34\ V$$

$$\therefore \boxed{Ey = \frac{-38.34}{0.5} = -76.68\ V/cm}$$

③ Angular Deflection

$$D = L \tan\theta \Rightarrow \theta = \tan^{-1}\left(\frac{D}{L}\right) = \tan^{-1}\frac{7}{40} = 9.926^{\circ}$$

④ Input signal

$$Ed = Vin * AV \Rightarrow Vin = \frac{Ed}{AV} = \frac{38.78}{80} = 0.47925\ V$$

⑤ CRT Sensitivity

$$S = \frac{D}{Ed} = \frac{7}{38.34} = 0.1825767\ cm/V$$

⑥ Change in deflection factor if input signal becomes 0.8V

When $Vin = 0.47925V$

$$G_1 = \frac{1}{S_1} = 5.47714 \text{ V/cm}$$

When $V_{in} = 0.8$ V :—

$$E_{d2} = V_{in} * AV = 0.8 * 80 = 64 \text{ V}$$

$$D_2 = \frac{1 L E_d}{2 d E_a} = \frac{6 * 40 * 64}{2 * 5 * 1.3145 * 10^3} = 11.685 \text{ cm}$$

$$G_2 = \frac{E_{d2}}{D_2} = \frac{64}{11.685} = 5.47714 \text{ V/cm}$$

$$\Delta G = G_2 - G_1 = 5.47714 - 5.47714 = \text{Zero}$$

Q7;

1. Diaphragm
2. Bellows
3. Bourdon tube. circular or twisted
4. Straight tube.
5. Mass contilever single or double suspension.
6. Pivot torque